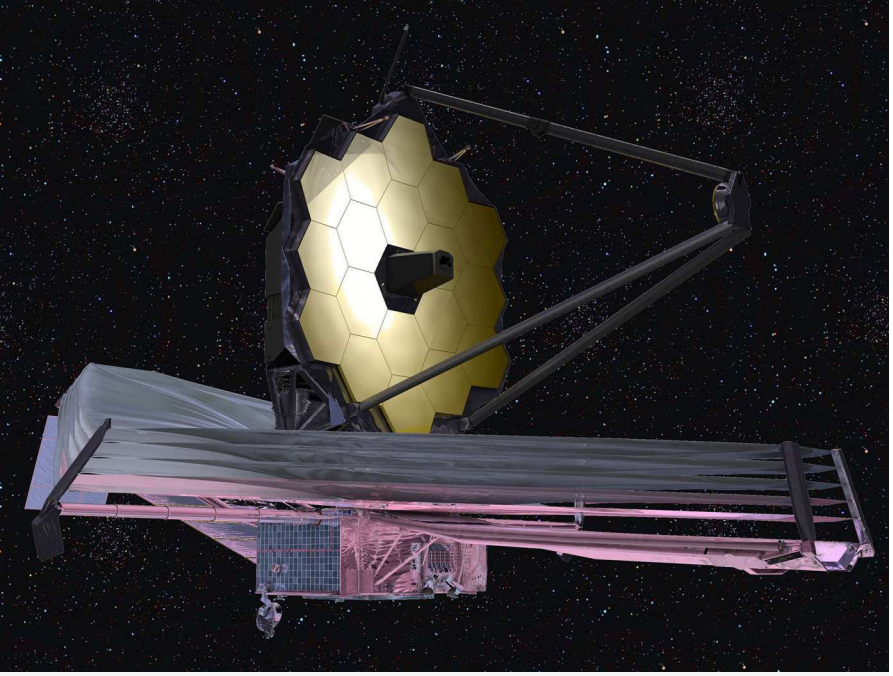

National Aeronautics and Space Administration

Materials and Coatings

Thin-Films with Integrated Structural and Functional Elements

Low mass, large-scale hierarchical thin-film structural systems with enhanced performance

NASA Langley Research Center has developed a technology to use commercially available additive print manufacturing to add various levels of structural hierarchy to thin-film surfaces. The approach adds very little mass to thin-films, but provides substantial performance enhancements, such as increased damage tolerance to tearing and ripping. NASA developed this technology to provide new and improved ways to produce robust ultra-lightweight space structures such as solar sails, solar shades, and antennas. Beyond space applications, the technology is well suited for other thin-film applications.

BENEFITS

- Provides substantial thin-film structural performance with little added weight
- Cost-effective, scalable, high-volume manufacturing approach
- Customizable and allows for complex and optimized features

APPLICATIONS

- Solar space sails, arrays, and concentrators
- Space antennas and sun shades
- Inflatable structures (both earth and space based)
- Chemical and radiation sensors

technology solution

THE TECHNOLOGY

The technology uses additive print manufacturing to produce hierarchical and integrated structural and functional elements into large-area thin-film structures. Adding these structural and functional elements has the potential to enable very lightweight, large-scale thin-films with improved damage tolerance, self-deployment capability, flexibility, and multifunctional (optical, thermal, electrical) connectivity and interrogation capabilities. Based on simple and proven additive manufacturing concepts, advanced geometrical, biomimetic (insect wing), and hierarchical structures could be applied to, or eventually with further development integrated within the bulk of large-area thin films using roll-to-roll processing techniques for a potentially low-cost manufacturing approach. The subject technology potentially addresses many of the disadvantages of current large-scale membrane material systems, which are prone to damage or require extensive deployment and support structures.

Thin-film specimen under load with rip-stop lines.

PUBLICATIONS

Patent Pending

More Information

National Aeronautics and Space Administration

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NP-2015-08-2042-HQ

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LAR-17994-1